CONVAIR-580 STATE PARAMETER CALIBRATIONS FOR PRE-SAFARI 2000

Name of Instrument and Parameter: Rosemount (Model 830BA) pressure

Date of Calibration: None

Method of Calibration: None. Normally calibrated via flyby of the Paine Field tower using a calibrated aneroid barometer in the tower and the aircraft flies by at the same level as the barometer. However, no flyby was done prior to the SAFARI project. A mid-SAFARI check of the Rosemount sensor revealed no discrepancies (see appropriate form).

Person Carrying Out Calibration:

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RESULTS OF CALIBRATION

Conclusions: No action required.

Name of Instrument and Parameter: Reverse flow temperature (in- house manufactured)

Dates of Calibrations: 25 July 2000 (Local Daylight Time/Date), UW flight 1809

Method of Calibration: Two coordinated flights with NWS rawinsondes launched from Quillayute, Washington, were carried out. The first, on 20 July 2000 (Flight 1808), and the second was on 25 July 2000 (Flight 1809). Due to a faulty rawinsonde or faulty data transmission, no data were available from the rawinsonde at 0000 UTC on 21 July 2000. Therefore, only data from the second comparison on 25 July (the 0000 UTC 26 July sounding) are discussed. This comparison uses those data acquired in the ascent from the surface to 700 hPa, the top of the coordinated ascent.

Person Carrying Out Calibration: CARG crew

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RESULTS OF CALIBRATION

A comparison of the raw reverse flow temperature (tstatr) and the NWS rawinsonde temperatures at mandatory and "significant" levels shows that the CV-580 reverse flow temperature was generally lower than the rawinsonde temperature from the surface through 700 hPa. The regression equation that best adjusts the negative offset in the temperature, in degrees Celsius, is:

$$tstatr_{corrected} = 0.9\ (tstatr_{raw}) + 1.8 \qquad (1)$$

Conclusion: For UW flights 1810 (beginning of SAFARI 2000) through 1820 apply Eqn (1) to obtain the most accurate values of the reverse flow temperature. (A coordinated ascent with a rawinsonde took place in Pietersburg, South Africa, on flight 1821; adjustments to Eqn (1) based on this comparisonare addressed in the MID-SAFARI calibration forms.)

The effect of the adjustment factor is demonstrated by comparing Figures 1 and 2.

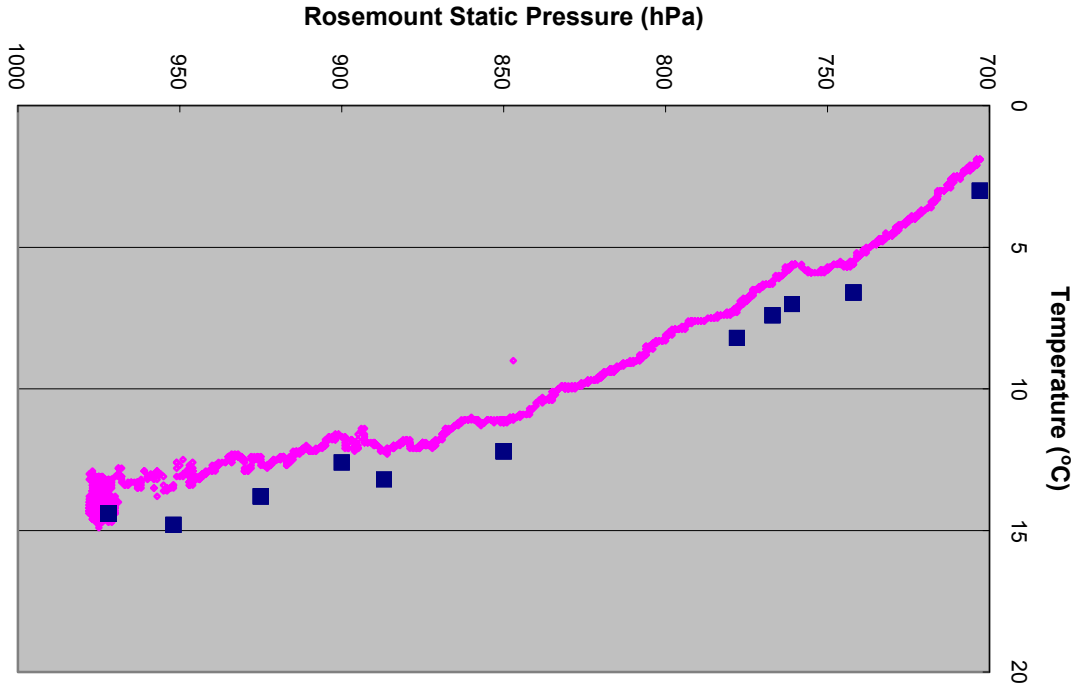

Figure 1. A comparison of the NWS Quillayute, Washington, rawinsonde temperatures (solid squares) and the raw reverse flow static temperatures (light gray line). The rawinsonde was launched at 0000 UTC, 26 July 2000.

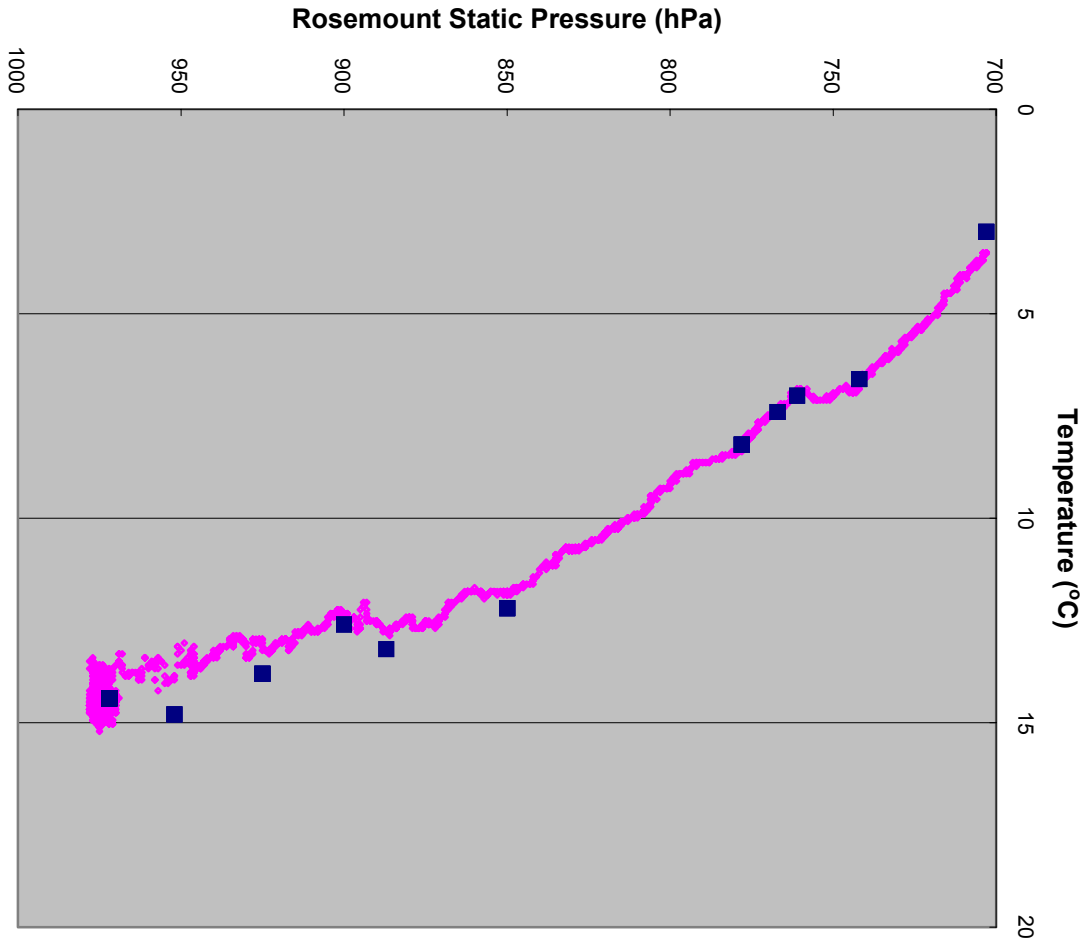

Figure 2. A comparison of the NWS Quillayute, Washington, rawinsonde temperatures (solid squares) and the adjusted reverse flow static temperatures (light gray line) from Eqn (1). The rawinsonde was launched at 0000 UTC, 26 July 2000.

Name of Instrument and Parameter: Rosemount (Model 102CY2CG) static temperature

Dates of Calibration: 25 July 2000 (Local Daylight Time/Date), UW flight 1809

Method of Calibration: Coordinated ascent with the NWS Quillayute, Washington rawinsonde on 26 July, 0000 UTC.

Person Carrying Out Calibration: CARG personnel

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RESULTS OF CALIBRATION

The Rosemount temperature (tstat) was about 6-7 deg C higher than the rawinsonde and reverse flow temperatures (tstatr). The cause of this sudden large discrepancy between tstat and the rawinsonde temperatures has not been determined (the sensor was apparently damaged sometime in the ferrying of the aircraft from Kwajalein, Marshall Islands, to Seattle, USA (D. Spurgeon, private communication). The Rosemount sensor had always been the source of our most accurate temperature measurements. Further, it does not appear to be correctable since the discrepant temperature drifted in level flight.

Conclusion: The Rosemount temperature data should not be used in SAFARI 2000.

Name of Instrument and Parameter: Cambridge (Model TH73-244) dew point temperature

Dates of Calibrations: 25 July 2000 (Local Daylight Time/Date), UW flight 1809

Method of Calibration: Coordinated ascent with the NWS Quillayute, Washington, rawinsonde at 0000 UTC 26 July 2000.

Person Carrying Out Calibration: CARG personnel

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RESULTS OF CALIBRATION

A comparison between temperatures measured by the NWS rawinsonde launched at 0000 UTC on 26 July 2000 and the Cambridge chilled mirror dewpoint temperatures showed extremely high correlation (r=0.99) but the Cambridge dewpoints were lower by about 1.5° to 2° C, although larger dewpoint temperature differences were occasionally observed. Some of the larger offsets can be attributed to differences in the path of the aircraft from the path taken by the balloon, particularly near the top of moist layers.

The equation that best adjusts the Cambridge dewpoints to the rawinsonde dewpoints, in degrees Celsius, is given by:

$$dp_{corrected} = 0.86(dp_{raw})+1.6 \qquad (2)$$

Conclusion: For UW flight 1810 (beginning of SAFARI 2000) through UW flight 1820, apply Eqn (2) to obtain the most accurate values of the Cambridge chilled mirror dewpoint temperatures. The effect of the adjustment factor is demonstrated by comparing Figures 3 and 4.

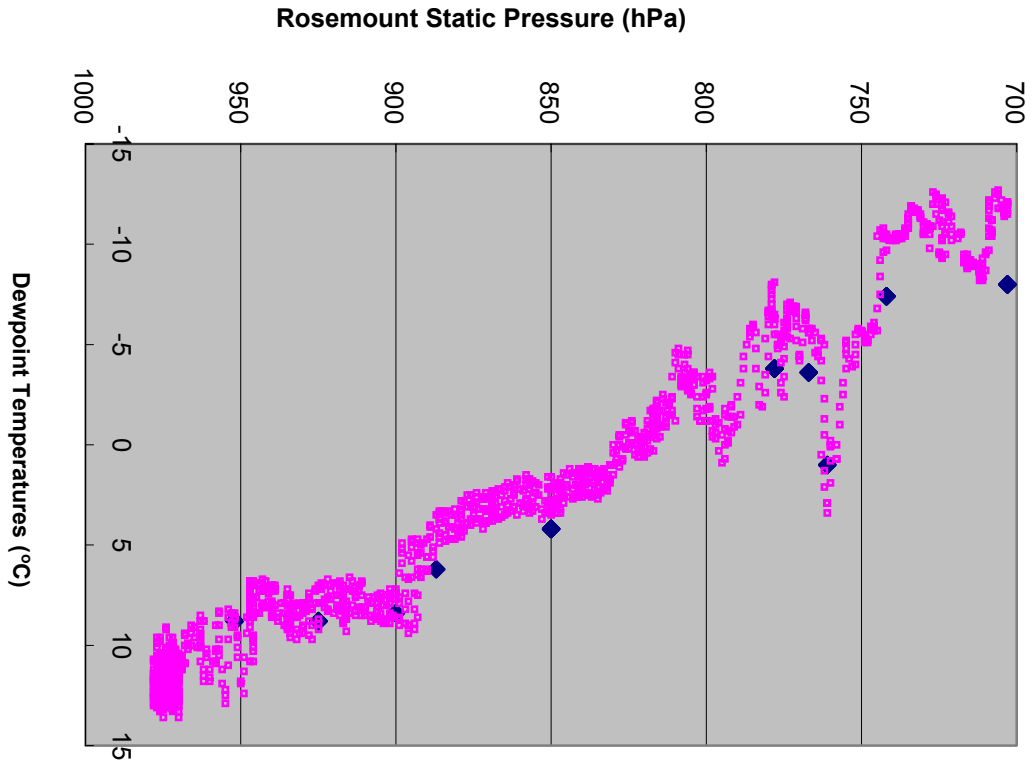

Figure 3. A comparison of the NWS Quillayute, Washington, rawinsonde dewpoints (solid diamonds) and the raw Cambridge chilled mirror dewpoint temperatures (light gray line). The rawinsonde was launched at 0000 UTC, 26 July 2000.

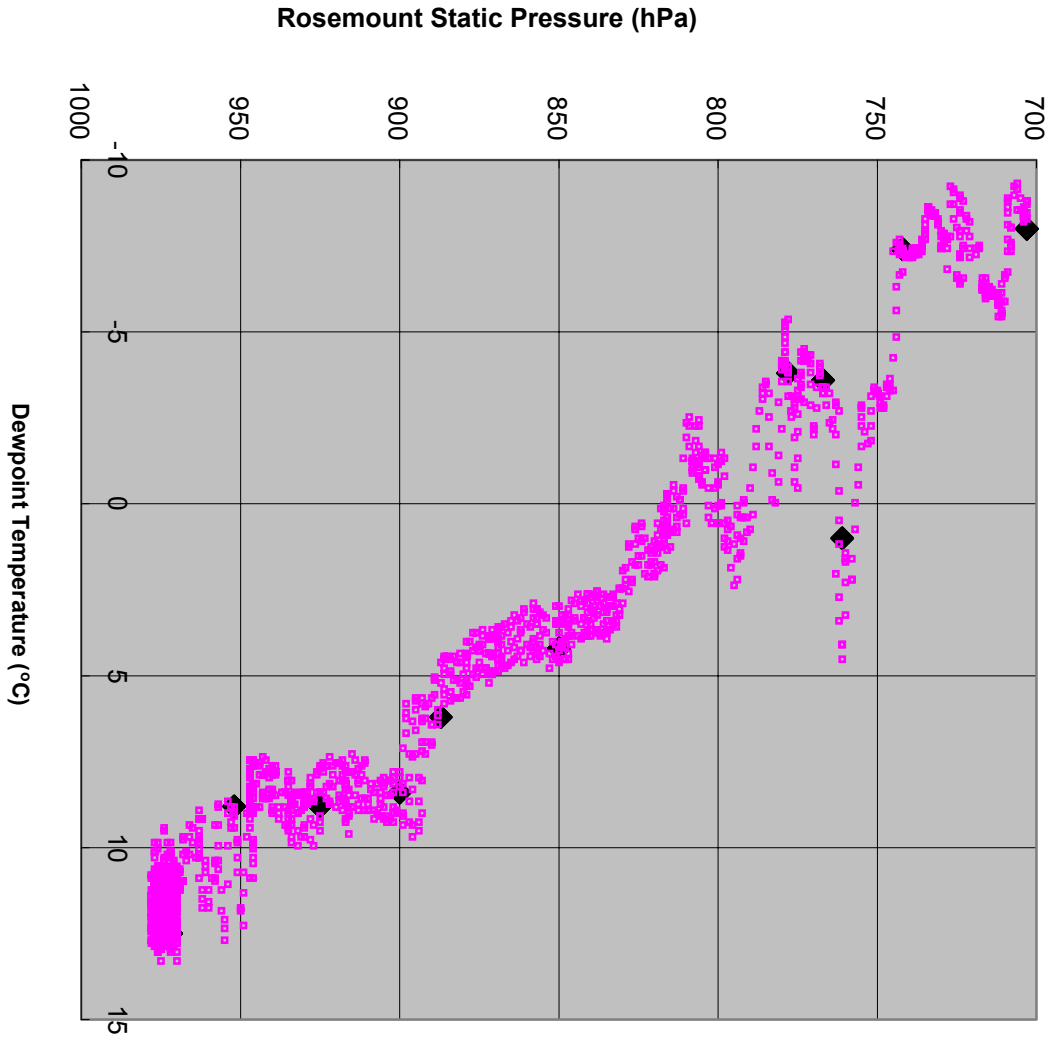

Figure 4. A comparison of the NWS Quillayute, Washington, rawinsonde dewpoints (solid diamonds) and the adjusted Cambridge chilled mirror dewpoint temperatures from Eqn (2) (light gray line). The rawinsonde was launched at 0000 UTC, 26 July 2000.

Name of Instrument and Parameter: Ophir (Model IR-2000) absolute humidity

Dates of Calibrations: 29 July 2000, UW flight 1809

Method of Calibration: Coordinated ascent with the NWS Quillayute, Washington, rawinsonde at 0000 UTC 26 July 2000.

Person Carrying Out Calibration: CARG personnel

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RESULTS OF CALIBRATION

A comparison between the rawinsonde launched from Quillayute, Washington, at 0000 UTC 26 July 2000 and dewpoints derived from the Ophir-measured absolute humidity showed a high correlation (r=0.98) and good agreement. The difference between the two dewpoints was less than 2 deg C overall—considered excellent. Larger point differences were observed in the comparison, but these were likely due to differences in the location where the aircraft flew and the path taken by the balloon. The Ophir-derived dewpoints were slightly higher than the rawinsonde dewpoints at higher temperatures, and slightly lower than the Ophir-derived dewpoints at lower temperatures. Also contributing variance to this comparison of unsmoothed dewpoints is low frequency

(<1 Hz) cyclical electrical noise in the Ophir data. A least squares fit between the rawinsonde and Ophir-derived dewpoints produced:

$$dp\_o_{adjusted} = 1.09(dp\_o_{raw}) - 0.1 \qquad (3)$$

Conclusion: The above correction is minimal (compare Figures 5 and 6) and is not likely to appreciably improve the raw Ophir-derived dewpoint values. Thus, it is recommended that no corrections be applied to the Ophir-derived dewpoint temperatures from UW flight 1810 (beginning of SAFARI 2000) through UW flight 1820 in SAFARI 2000.

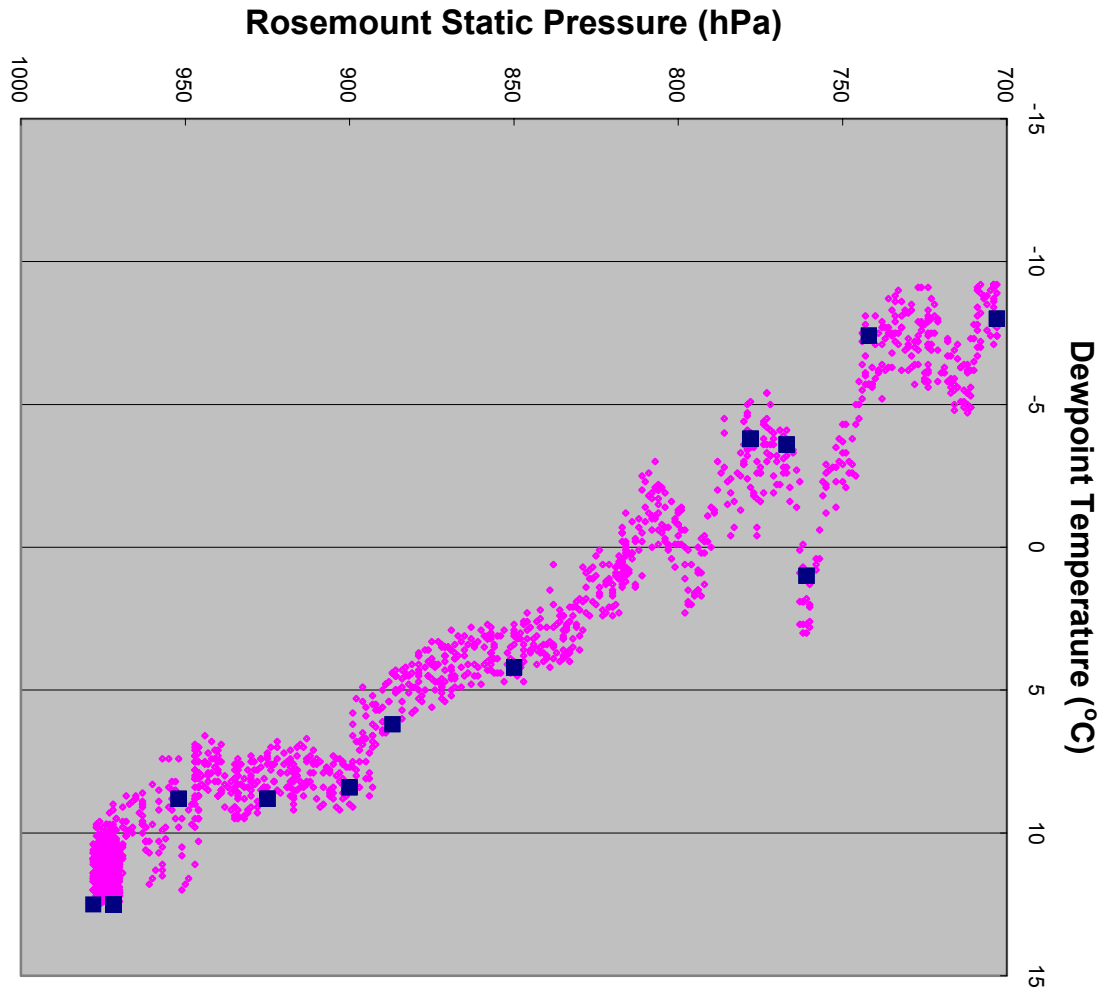

Figure 5. A comparison of the NWS Quillayute, Washington, rawinsonde dewpoints (solid squares) and raw Ophir-derived dewpoints (small light gray dots). The rawinsonde was launched at 0000 UTC 26 July 2000.

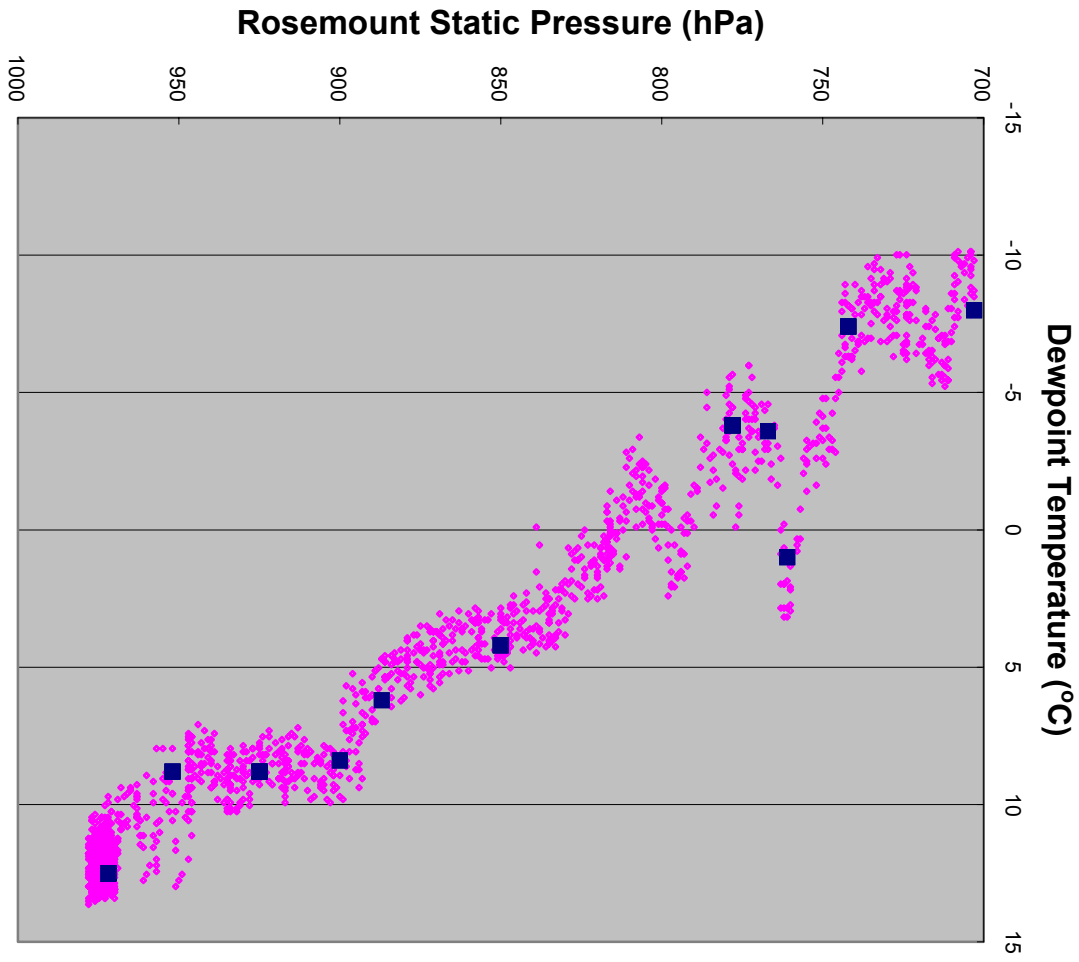

Figure 6. A comparison of the NWS Quillayute, Washington, rawinsonde dewpoints (solid squares) and adjusted Ophir-derived dewpoints from Eqn. (3) (small light gray dots). The rawinsonde was launched at 0000 UTC 26 July 2000.

Name of Instrument and Parameter: Omega Engineering (Model 0S3701) surface temperature

CONVAIR-580 STATE PARAMETER CALIBRATIONS FOR PRE-SAFARI 2000

Date of Calibration: None

Method of Calibration: NA

Person Carrying Out Calibration: NA

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RESULTS OF CALIBRATION

Calibration of this instrument was not carried out. While not calibrated, the qualitative temperature trends when the aircraft was flying within about 500 m of the surface appear reliable. Can also be used for fire, cloud or smoke width estimates on some occasions when the aircraft is close to the surface or the top of the cloud/dense smoke was just below the aircraft.